

Engineers Australia
Engineering Heritage Victoria
Engineering Heritage Australia, Heritage Recognition Program

Nomination

for the

BETHANGA BRIDGE



July 2015

Front Cover Photograph

The Bethanga Bridge photographed from the New South Wales bank of Lake Hume looking at the south side of the bridge. The original concrete abutment is at left. Part of the tenth (beam) span is concealed behind some bushes at far left of the photo.

Photo: M. Doring, 19th June 2015.



Above: Bethanga Bridge viewed from the NSW bank at the end of the 14 metre 1963 approach span.

The two concrete posts mark the location of the original concrete abutments.

The posts are marked with the date 1930. Two cars in the distance are approaching the Victorian bank.

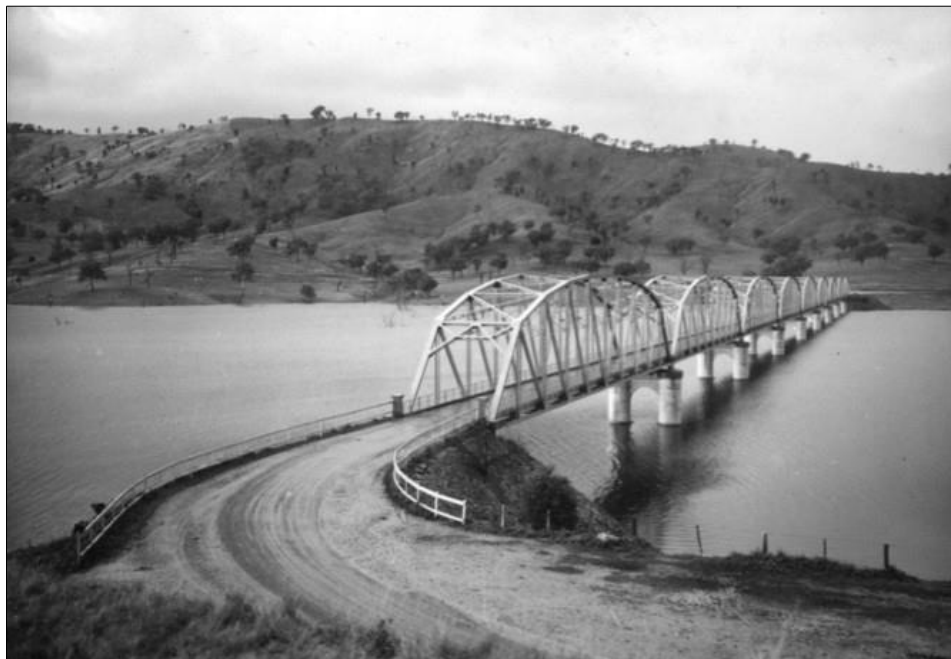
Photo: M. Doring, 19th June 2015.

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1 Introduction¹

The Bethanga Bridge is a long, nine-span, riveted-steel, variable depth, Pratt Truss road bridge of nine principal spans of 82 metres and a total length of 752 metres over the flooded valley of the Murray River, now part of Hume Reservoir. The bridge dates from 1927-1930 when the Hume Weir was completed and the backed-up waters inundated this section of the river and consequently cut off the old low level bridge² over the Murray. The State Rivers and Water Supply Commission of Victoria and the New South Wales Department of Public Works were responsible for the construction works for the Hume Weir under the River Murray Waters Agreement. It is apparent that the similar joint arrangement was made for construction of the Bethanga Bridge as part of the Hume Weir works. Charles Ruwolt Pty Ltd of Melbourne fabricated the truss spans.



Left: The Bethanga Bridge photographed in 1946 from the New South Wales side, before an extra 14 metre steel girder span was added onto the nearest truss span at the NSW end in 1963.

Photo: Victorian State Rivers & Water Supply Commission – builders of the bridge.

Right: One of the Bethanga Bridge camelback Pratt Truss spans erected in the Charles Ruwolt company yard at Victoria Street, Richmond in Melbourne in 1929 before being deconstructed and packed for shipment by train to the construction site in New South Wales.

Photo: From the Vickers Ruwolt Collection in the Museum of Victoria.



1 Introduction quoted from the *National Trust of Australia (Victoria) Initial Draft Classification Report* for the Bethanga Bridge.

2 The low level bridge referred to crossed the river from Gold Creek in Talgarno to Hawksview in NSW.

2 Heritage Award Nomination Letter

The Administrator
Engineering Heritage Australia
Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

Name of work: Bethanga Bridge

The above-mentioned work is nominated to be awarded recognition under the terms of the Engineering Heritage Australia Heritage Recognition Program.

Location: Carries the Riverina Highway over the Murray Arm of the Hume Weir (flooded area of the Murray River valley) from Albury City, New South Wales LGA to Bellbridge, Towong Shire, Victoria LGA.
Map Grid Reference: Latitude: -36.0879820891 Longitude: 147.0557542060

Owner (name & address): Roads and Maritime Services New South Wales
Head Office: 101 Miller Street North Sydney NSW 2016
South West Office: 1 Simmons Street Wagga Wagga NSW 2650

The owner has been advised of this nomination and a letter of agreement is attached.

Access to site: via the Riverina Highway from Albury.

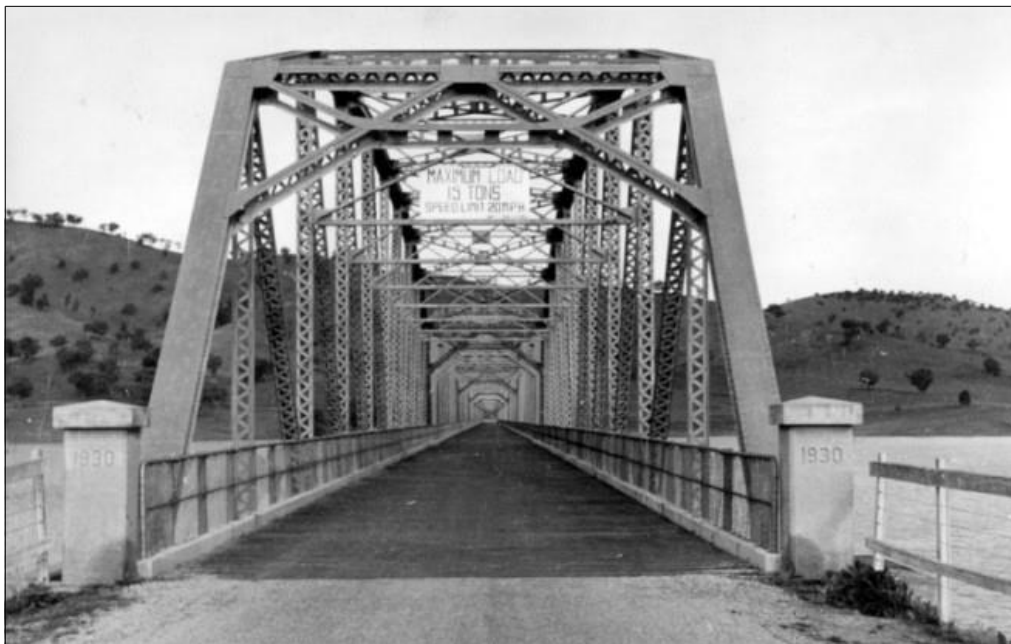
Nominating Body: Engineering Heritage Victoria

Owen Peake
Chair, Engineering Heritage

Victoria Date: 27 July 2015

3 Heritage Assessment

- 3.1 **Item Name:** Bethanga Bridge
- 3.2 **Other/Formal Names:** n/a
- 3.3 **Location:** Carries the Riverina Highway over the Murray Arm of the Hume Weir (flooded area of the Murray River valley) from Albury City, New South Wales LGA to Bellbridge, Towong Shire, Victoria LGA.
Map Grid Reference: Latitude: -36.0879820891 Longitude: 147.0557542060
- 3.4 **Address:** Riverina Highway, Albury City NSW or Bellbridge, Talgarno Road, Victoria.
- 3.5 **Suburb/Nearest Town:** Bellbridge, Victoria.
- 3.6 **State:** New South Wales (part Victoria)
- 3.7 **Local Govt. Area:** Albury City NSW (part Towong Shire Victoria)
- 3.8 **Owner:** Roads & Maritime Services NSW, an agency of the NSW Government.
- 3.9 **Current Use:** road bridge
- 3.10 **Former Use:** road bridge
- 3.11 **Designer:** Office of Percy Allan, Chief Engineer, NSW Department of Public Works.
- 3.12 **Maker/Builder:** Steelwork and trusses – Charles Ruwolt Pty Ltd of Richmond, Victoria
Construction – State Rivers and Water Supply Commission of Victoria
- 3.13 **Year Started:** design 1926 construction 1927
- 3.14 **Year Completed:** 1930



Looking along the Bethanga Bridge from the New South Wales end.

In 1956 the bridge still had the original transverse timber decking that made the characteristic loud rattling of traditional NSW bridges.
From the writer's memory, there was still a gravel road leading up to the ends of the bridge.

Note the posts at the abutment with 1930 incised in the concrete.

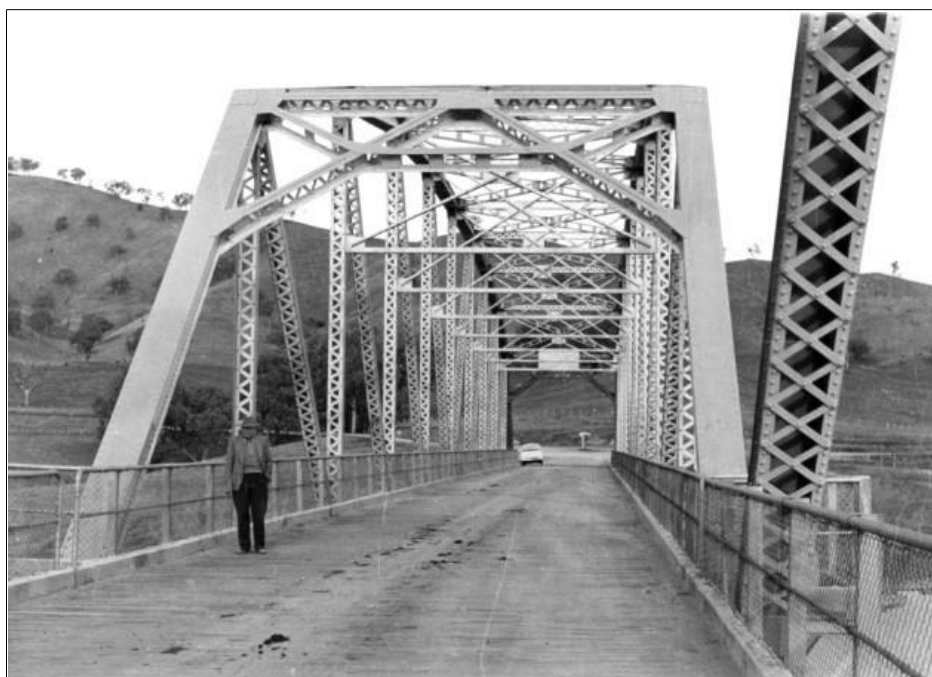
Photograph: From Michael Clarke, taken 1st August 1956.

3.15 Physical Description: from the NSW State Heritage Register ³

The Bethanga Bridge is a road bridge over a flooded section of a Murray River valley that now forms part of the Hume Dam. The bridge consists of nine identical spans of 82 metres, each span being supported between double reinforced-concrete pylons by a riveted-steel camel-back Pratt Truss. There is also a 14 metre steel girder approach span on the New South Wales side. This has RSJ girders with straight transverse cross-bracing. It was added in 1963 as part of the upgrading of the Hume Dam. The overall span of the bridge is 752 metres.⁴

According to the RTA bridge card, abutment A is at the Victorian side and abutment B is at the NSW side. Abutment A is supported by a concrete wall the first two supports, last two supports and abutment B consist of concrete columns on concrete footings. The central five support structures are concrete columns on concrete pile caps with driven concrete piles beneath.

The road surface was initially transverse laid timber decking but this was replaced in 1961 with a concrete waffle slab deck. The road deck is 7.7 metres wide. In 1961 the bridge deck and truss structure was also raised by 300 mm in response to the upgrading of Hume Dam, and works to increase its storage capacity. In 2005 the 1961 waffle slab decking was replaced to raise the load capacity, new guard rails were installed and the NSW approach to the bridge was widened for safety reasons. Concrete end-posts frame the entry to the bridge. The construction date is cast in one end-post. These 2005 works were undertaken with the joint advice and approval of Heritage Victoria and the NSW Heritage Office.

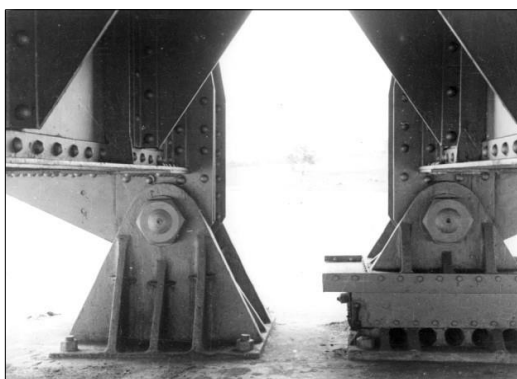


Looking along the last truss on the Victorian side of the Bethanga Bridge towards the Victorian end.

In 1956 the bridge still had the original transverse timber decking that made the characteristic loud rattling of traditional NSW bridges.

Note the (also characteristic) deposits of cattle droppings, and the safety refuges for pedestrians at each side of the end of the truss.

Photograph: From Michael Clarke, taken 1st August 1956.



Far Left: The underside of the deck structure showing the concrete waffle slab from 2004. Photo: From On my Doorstep.

Left: Bridge bearings at Pier 9-1. Photo: From Michael Clarke. Taken 31st July 1958.

³ The physical description of the Bethanga Bridge is taken directly from the *NSW Office of Environment & Heritage State Heritage Register entry No.01750 for the Bethanga Bridge* and from the *Roads & Maritime Services Heritage & Conservation Register*.

⁴ In the NSW Heritage Register description, the clear height is given as 25 metres, but there is no explanation as to what this means. Could it mean from minimum water level, or the original river bed, to road deck, or the top of the trusses, or some other measurement?

The Pratt Truss:

There are nine identical principle spans of Pratt trusses with arched upper cords giving trusses of variable depth. This form of truss is also known as “Hog-backed”, “Camel-back” or “Parker” truss in the USA. Each truss has overhead diagonally braced frames and under deck diagonal “X” bracing between riveted plate-girder cross beams. Each Pratt truss has ten bays with nine vertical compression chords and eight diagonal tension chords. The Pratt truss was an American style bridge truss that began the tide of change from British to American bridge technology in the nineteenth century. The Bethanga example comes from a period when Pratt trusses were an established design alternative, favoured by railways [and used in NSW road bridges] but generally shunned in Victorian road bridge design. It is a type of truss in which vertical web members are in compression and diagonal web members in tension. Many possible configurations include pitched, flat, or camel-back top chords. It may be recognised by diagonal members which appear to form a “V” shape toward the centre of the truss when viewed in profile. Variations include the Baltimore truss and Pennsylvania truss. Elaboration in the form of variable depth from sloping upper chords as in the Camel-back arrangement, reduced the amount of steel required, and also dead weight for a similar strength. The Pratt truss compares to Warren truss and Howe designs in the different compression and tension arrangements of diagonal and vertical members. It was named for Thomas W. and Caleb Pratt (Boston railway engineers), who were issued a patent for a truss bearing their name in April, 1844.

(Waddell 1891; Hughes Trueman Reinhold 1998; RTA NSW.)

3.16 Physical Condition: Good, well maintained.

3.17 Modifications and Dates:

1961 - timber deck replaced with a concrete waffle-slab deck. Bridge deck and truss structure was raised by 300 mm

1963 - steel girder approach span added on the NSW end.

2005 - 1961 deck replaced with interlocking pre-cast concrete slabs.

3.18 Historical Notes:**3.18.1 Crossing the Murray River before the Hume Dam was built:⁵**

The first white settlers of Talgarno came to the region in the 1840s and by the late 1850s a plan of blocks of land for a small township of Talgarno was surveyed. In 1863 a road was surveyed to it, or through it, but what sort of road it was, is not explained. The first Talgarno and Bethanga settlers are said to have crossed the river from NSW via a punt moored close to the Cumberoona homestead. Cumberoona was the next pastoral station up the river from Bowna station and Bowna station was next up the river from Hawksview. Although the place name Bowna survives on the map, all three river frontage stations have long vanished from living memory, probably because of closer settlement and inundation by the Hume Weir.

The early settlers of Talgarno and Bethanga stations were cattlemen. In the 1860s to 1870s the runs were worked together and carried 3,000 or more head of beef cattle. The first mob of sheep (around 3000 of them) was brought to the district in 1864, and they had to be swum across the river from near Wymah to Bungil. All these stock, when they went to market, had to be swum across the river to NSW, driven to Albury then back to Victoria across the bridge to Wodonga, to the markets there or the railhead. A vivid account of the common problems encountered with moving stock comes from W.H. Ferguson's *Doomed Talgarno*:

It has been mentioned that Mr. Wallace, the owner of Bungil, brought the first flock of sheep on to that run. The first settler on Talgarno to stock a selection with sheep was Mrs. Margaret Ferguson, at "Craigielea," Gold Creek. She, in 1881, brought 200 maiden merino ewes from Mr. James Mitchell, at Tabletop. They were driven along the Eight-Mile Reserve to the river, and Mr. Robert Drummond and his sons helped W. H. Ferguson to catch the sheep, tie their legs and boat them from New South Wales to Victoria. For this, permission was obtained from Mr. Cobham, the Inspector of Stock, and the Customs officials. At this time, the Stock Tax was heavy on all cattle and sheep being brought from New South Wales to Victoria. Along the river smuggling was not unknown. If cattle were grazing on the New South Wales side in a paddock with poor grass, and there was very good feed on the Victorian bank opposite, is it any wonder that on certain very dark nights cattle should be tempted to cross the river when it was running low. Then what more likely than that the owner should sell them to someone in Victoria just to save the trouble of driving them back.

The Drummond family came to Talgarno sometime in the 1860s and set up a dairy and made cheese, it is said about a ton per month, which was sold in Albury and Beechworth and thereabouts, and got there by the same route as the cattle and sheep.

⁵ Most of the information in Section 3.18.1 is taken from the small book *Doomed Talgarno*, by WH Ferguson. The present writer has to admit to a personal connection with the author of *Doomed Talgarno*. Mr WH Ferguson was her much loved Great-uncle Will and an eminent geologist, surveyor and discoverer of dinosaur fossils, as well as a farmer at Talgarno.

Despite the inconvenience and the rigours of getting their cheese to market, the business was successful enough to be incorporated as the *Talgarno Butter and Cheese Factory Company Limited* in 1892. Early orchards, and market gardens were tried, and grew excellent fruit and vegetables, but failed because of the usual problems with transport out of the district. A further selection from *Doomed Talgarno* tells the story of how the people of Talgarno, Bethanga, Granya, Bungil and beyond, finally got their much longed for *Gold Creek Bridge*. It also partly explains why the Hume Weir was considered such a disaster when the *Gold Creek Bridge* was going to be drowned, and why the Bethanga Bridge had to be built – whatever the cost:

From 1841 until 1896 the residents wishing to go direct to Albury had to ford the Murray at Gold Creek, or to cross in a small row boat, and make their horses swim across the stream. In the late "eighties" the residents of Talgarno began to agitate for a bridge, and to the great joy of all in the district, a bridge was built. The writer interviewed the Hon. W. J. Lyne, MLC for Hume, New South Wales. He had land opposite to Talgarno, and [the writer] inquired what chance there was of getting a bridge over the Murray. [Lyne] replied, "As much chance as there is of getting one to the moon". Well, we got our bridge, but the lunar suspension one is not yet completed. Mr. J. Wilkinson, MLC for Albury, etc., a solicitor, worked for the bridge, as did Mr. A.W. Craven, MLC for Benambra. The Albury City Councillors and Mr. J. McEachern, a well-known and popular townsman, greatly helped the Talgarno people in their efforts. The bridge is a wooden one, at a cost of £1760, where the river is 174 feet wide. It has resisted some big floods. Some years ago when the approaches were damaged the Talgarno residents had working "bees", and made repairs. The bridge has been a great boon, not only to Talgarno, but to people living on both sides of the Murray, as far as Tintaldra. Upper Murray residents cross the stream into Victoria, and re-cross on the bridge, thus shortening the journey to Albury. Much wool and livestock are taken across the bridge, and it has been the means of bringing much business to Albury. The Government kept a Customs Officer – Mr. Butler – at the bridge for some years. During a scare about a plague some years ago, a quarantine station was established at the bridge. Persons were kept there under supervision for some weeks.



Constable Family Picnicking Near The Gold Creek Bridge.

Left: The image shows the Constable family picnicking near the Gold Creek Bridge sometime after 1896. From what can be seen of the bridge at the top left corner, it resembles an Allan Truss type – a style invented by Percy Allan the designer of the later Bethanga Bridge.

Below: A small section of Broadbents Map No.321^E of the Eastern Half of Victoria & Southern NSW circa 1950. The black X on the Hume Weir to the right of Albury shows the location of the Gold Creek Bridge.



3.18.2 A Short History of the Bethanga Bridge from Marion Taylor:

In 2013, the Albury and District Historical Society organised a visit to the Bethanga Bridge. Afterwards, Ms Marion Taylor, of Tabletop NSW, gave a talk about the history of the bridge to the Society. The text of her talk is published here with permission.

One of the earliest mentions of the new Bethanga Bridge in the newspapers was in December 1925 when the Albury City Council requested support to have a bridge erected over the Murray to give Bethanga and Upper Murray residents continued access to their natural markets of Albury and Wodonga, as the new Dam would back up the Murray and Mitta Valleys for many miles. Support was given from the Wodonga and Hume Councils. The original costing was quoted as 300,000 pounds an enormous amount of money in those days. The population in the area at the time would have been minimal so I am assuming that there were residents who held considerable political influence to justify such a huge expense – or maybe they just had far sighted politicians in those days. Therefore the bridge is significant as a marker of the anticipated development that the new weir was expected to bring to the region, serving as it did, only a few small farming communities and the copper and gold mining areas of Bethanga and Talgarno, which were already in steep decline at the time the bridge was completed.

Bethanga Bridge was built with cooperation between NSW, Victorian and Commonwealth governments and was a key element of the River Murray Agreement. It is the only bridge crossing the Murray that is in two States and jointly owned. Elsewhere, all bridges are in NSW as the State Boundary is the bank on the Southern side of the River.

Tenders for the Bridge were advertised worldwide. I believe only two responses were received and the successful tenderer for the steel spans in June 1928 was Vickers Ruwolt of Richmond, Melbourne for 71,890 pounds. Previously this company had manufactured mining dredges at Wangaratta. Trade union officials in Melbourne were pleased as this meant work for 250 men for 12 months when engineering works were in a downturn.



Left: One of the Bethanga Bridge camelback Pratt Truss spans erected in the Charles Ruwolt company yard at Victoria Street, Richmond in Melbourne in 1929 before being deconstructed and packed for shipment by train to the construction site of the Hume Dam, and thence by horse-drawn timber jinkers to the bridge construction site in New South Wales.

Photo: From the Vickers Ruwolt Collection in the Museum of Victoria

The bridge was described as using riveted steel, camel back Pratt trusses, 9 spans of 82 metres, with an overall span of 752 metres using 1600 tons of steel. Designed in NSW by Roads Engineer Percy Allan. There is a photo of one of the steel trusses erected in the Ruwolt yard in Melbourne no doubt they just bolted it up to make sure it would all fit together correctly. The steel girders for the 9 spans were transported by broad gauge railway to the Victorian work site [of the Hume Dam] then hauled by horse drawn timber jinkers over the river, up the steep hill past the trout farm and stock piled on the NSW side. (1600 tons!)

Works commenced in Jan 1927 when a temporary bridge was erected over the River to provide access, power and water (6 months' work). The enormous concrete support towers and two end buttresses were then built. The 8 towers were over 100 foot high, 10 feet in diameter and hollow with 2 foot thick walls. The engineers invented a continuous pour system which moved [the formwork] up 1 foot at a time and the workers used hot water to mix the cement to make it cure quickly. Five of these towers are sitting on solid granite (40 foot down) and three towers couldn't find bottom so they drove in piles and poured a concrete raft to sit on them. All towers were erected in 12 months with men working two shifts. The men were brought into the site in train carriages along the NSW side. I would imagine they mainly lived in the Hume Weir village or commuted out from Albury. There was a Bethanga Bridge Post Office especially for the workers.

In the wet spring of 1929 a cable punt (initially a pile driving barge from the dam wall construction) operated across the water near the new Bridge. This was necessary as the waters were slowly rising as the Dam was now successfully blocking the River and the old bridges had gone underwater. This half hour “boat” trip was initially quite a novelty for the locals. When the new bridge was opened this punt went on to provide service as the Wymah Ferry.

Before the waters had risen the engineer, Mr Thompson, had had large wooden piles driven in between the spans, these piles were used as bases for the scaffolding towers which were worked off when putting the steel spans together. The wooden scaffolding towers were then floated from span to span and divers were used to attach these towers to the base piles as the water rose. As the steel spans moved quickly out over the waters, 1 span was completed every 3 weeks, a railway line was built out to carry a creeper crane which lifted in the steel for the next span. A three inch curve [camber] was put in each span which came out when the timber support scaffolding was removed and the weight of the span straightened the steel. Red hot rivets heated in hand cranked furnaces were used to join the steel girders together.

The Bridge was completed in Sept 1930, built and painted in under three years, one of the longest road bridges in Australia at the time and apparently opened with little fanfare, all the glory going to the Dam opening five years later.

Wage increases were said to have doubled the cost of the Bridge, one quote of total final cost given in 1930 was 194,000 pounds another given in 1932 was 210,000 pounds. Unlike the Sydney Harbour Bridge, whose steel work was manufactured and imported from England, the Bethanga Bridge was totally Australian made. Amazingly no workers' lives were lost building the Bridge.

After the opening, Victorian farmers who used the Bridge to walk livestock to Wodonga markets were hit with NSW Pastures Protection Board fees for travelling stock permits even though they were only moving them two miles through NSW until they crossed back into Victoria over the Murray River Bridge. This resulted in a long saga of political handballing which was only resolved 10 years later with the gazetting of a new regulation under the Pastures Protection Act that stated: *No rate shall be charged when stock travel from another State through NSW to a destination in the first mentioned State when the total distance travelled does not exceed three miles!* Much celebration from the farming community!

In 1961 the original, ratty Brush box timber deck was replaced by concrete and the bridge deck and truss structure raised 300mm when the height of the Dam wall was raised.

In 2005 NSW and Victoria agreed to a \$13 million project to refurbish the Bridge. This involved repainting, erecting new safety barriers and replacement of the 45 year old concrete deck. This doubled the [allowable] load limit on the Bridge from 15 tons to 30 tons, and by using interlocking precast concrete slabs [for the deck], eliminated the 300 expansion joints on the Bridge which made the distinctive clickity clack noise while crossing. The precast slabs were poured at a business in North Albury. Survey works at the time revealed the marked State Border on the Bridge was favouring Victoria by about a metre. The steel spans were all stripped and repainted. As the old paint was lead based, whole sections had to be wrapped and vacuum packed to avoid pollution of the water below. Other challenges faced by the project were working around two sets of road rules, double the Worksafe and Union regulations and cross border maritime issues. I am sure things were much simpler in 1929!

The bridge has aesthetic and architectural significance for its dramatic rural setting over a wide expanse of water at high lake levels, and occasionally at great heights over broad river flats when the lake is down. The vast scale and length and the rhythmic patterning of repeated geometric motifs of the trusses is very pleasing to the eye. As we look at the Bridge today I am sure you agree that it is most appropriate that it is now listed on both the NSW and Victorian Heritage lists as a wonderful example of engineering works in the 1920s and a tribute to the men who worked on it.

3.18.3 Historical Notes from the NSW State Heritage Register

The Context:

The first crossing of the Murray River by white men occurred in November 1824 when Hamilton Hume and William Hovell led an expedition from Yass in search of an overland route to Westernport Bay. Their crossing point was some distance up river from Albury and an obelisk near the river commemorates this. Hume and Hovell came upon the river on the 16th of November, 1824, naming it the Hume River, and inscribing a tree near the riverbank the next day before moving on to the south. In 1829, the explorer Captain Charles Sturt discovered the Hume River downstream at its junction with the Murrumbidgee River. Not realising it was indeed the Hume, he named it the Murray River. Both names persisted for some time, Hume falling into disuse eventually in favour of Murray. The explorers route was shortly followed by white squatters and their livestock, mainly sheep and cattle. Subsequently many families took up parcels of grazing land on the rich river flats, among the first being William Wyse and Charles Ebdon.

The drovers track that developed along the line of the advancing squatters, and subsequently by their excess stock returning for sale at Melbourne and Sydney markets, led naturally to the point where Hume and Hovell first sighted the river. Although an easier crossing point could be found 10 miles upstream (where the Hume Dam now stands) the original site by Hume and Hovell's inscribed tree became the popular crossing place for people and stock on their way to new settlements in the south.

Crossing the river during the drier summer months could normally be achieved on foot. When the river was high after heavy rains or snow melting in the mountains crossing became difficult until a log punt was built in 1844. Stock, however, had to swim.

The first bridge over the Murray was built in 1860 near the present crossing at Albury. People up and down stream had to find their own fords, or trek back to Albury. The arrival of the first railroad from Melbourne in 1873 boosted the district and captured the Southern Riverina markets for Melbourne. The rail line from Sydney reached Albury in 1881, but the first railway bridge over the Murray was not opened until 1883.

The Bethanga-Talgarno gold and copper field became one of the top copper producers in Victoria although both minerals proved difficult to extract from the intractable ores. The alluvial field was first reported in 1852 and was visited by mining officials in 1854, but the field was not really opened up until the discovery of the “New Year's Gift” reef on 1st January 1876. This led to a number of highly capitalised mining ventures. Harris and Hollow, a mining partnership from Rutherglen, built a smelting works on the flats of lower Bethanga with a view to smelting copper for the public and opened the first furnace of their Great Eastern Copper Smelting works in January 1878. J.A. Wallace MLC took an interest in the Bethanga Mining Scene and purchased mining leases and major mines at Bethanga, then built his own smelting works to treat the ore, completing three furnaces by June 1878. The Bethanga Goldfields Ltd company made a takeover in 1895 and both metals were mined and treated. Mining however, continued only sporadically into the 20th century, with further leads opened at Mt Corryong and Mt. Talgarno. There was a brief revival in the 1930s and some mines struggled on to at least 1945, but in the latter half of the 20th century mining ceased and the town gradually diminished (Bannear).

Construction of the Hume Dam:

The concept of damming Australian rivers for irrigation and flood mitigation was first investigated back in the days of the steamers. The Hume Dam was proposed under the River Murray Waters Agreement, which was signed on 9th September 1914, by the Prime Minister, Joseph Cook, and the Premiers of New South Wales, Victoria and South Australia. The first sod of the dam was turned by His Excellency, the Right Honourable Sir Ronald Crawford Munro-Ferguson, Governor General of Australia, on 28th November 1919. Construction of the weir took seventeen years with the reservoir being completed and officially opened by the Right Honourable Lord Gowrie, Governor of NSW, on the 21st November 1936 and a plaque on the northern pier of the dam commemorates the occasion. Bethanga Bridge was evidently constructed in the middle of this period, starting with design work in 1926 and completed in 1930 when the bridge was opened.

H. V. Beresford was construction engineer on the Hume Weir from about 1925, but he died while still engaged on the project in 1927. At the height of construction, more than 1100 workers were employed at the site. These workers were housed in two fully serviced towns adjacent to the site, one on either side of the river (River Murray Commission 1928).

Three engineers of note were involved in formulating the agreement, E M de Burgh in New South Wales, J S Dethridge in Victoria, and G Stewart in South Australia. The initial designs for Hume Dam were prepared by E M deBurgh, Chief Engineer of the Water Supply Branch of the Public Works Department NSW and J S Dethridge, Commissioner, State Rivers and Water Supply of Victoria. NSW was responsible for construction of the concrete dam and the State Rivers and Water Supply Commission of Victoria was responsible for the southern earth embankments.

Another Victorian engineer, Ettore Checchi (1853-1946) was closely connected with the Hume Dam project in the 1920s and 1930s. However, as his skills were with hydrographic work, it is unclear what contribution he had to the associated structures such as Bethanga Bridge. The State Rivers and Water supply Commission undertook at least some of the Hume Weir works in conjunction with the NSW Public Works Department. The River Murray Commission evidently had an overriding supervision of the works, but engineering and design details were left to the established public works engineers in the two states.

The heavy cost of Victoria's irrigation infrastructure lead to a parliamentary inquiry into the Commission's finances in 1928, and recommendations against further irrigation investment in an era of low export returns from primary produce. However, the Hume scheme appears to have been immune to any cuts due to the State-Federal agreement and the advanced stage of the project. The NSW Department of Public Works carried out modifications [to the dam walls] between 1950 and 1961 to enlarge the dam to about twice its original size to the present capacity of 3038 gegalitres to accommodate diverted water from the Snowy Mountains Scheme. As a result of the construction of the weir, the water level in the Murray River backed up behind the dam to permanently inundate the flood plain, which was up to several kilometres wide in many places.

Building the Bethanga Bridge:

Although confirmation of the construction authority is yet to be found, there is later evidence in the form of lantern slides showing the construction of the bridge (and clearly intended for public presentation), that the bridge construction was substantially the work of the SRWSC (SRWSC collection State Library of Victoria Pictures Collection). The involvement of the NSW Public Works Department is also implied by photographs of components [designed by Percy Allan's office and] fabricated by Charles Ruwolt and Sons, held by Museum Victoria. It is therefore very likely that the New South Wales Public Works Department and the Victorian State Rivers and Water Supply Commission (SRWSC) were jointly responsible for the design and construction, as was the case with the Hume Dam itself.

Bethanga Bridge is roughly contemporary with and is similar in design to the Yarrawonga Bridge at Lake Mulwala, which was designed by NSW Department of Main Roads Engineer Percy Allan and constructed in 1924, also as a result of the creation of an artificial lake on the Murray River. The other prominent engineers involved in the Hume Project, Ettore Checchi, E M deBurgh, and J S Detheridge, were water supply engineers or had ceased to be involved when the bridge was built.

There was a pattern in NSW/Victoria relationships over the Murray River border for NSW to design Murray River bridges, and Victoria to build them. Other examples of the arrangement can be found in the Swan Hill bridge and many timber bridges. Bethanga bridge is similar to other large NSW bridges such as the Hawkesbury bridges, and uncharacteristic of Victorian bridge design practice. The sequence of SRWSC lantern slides show the progressive construction of the Bethanga Bridge. Construction commenced in 1927 with clearance of the foundation sites and piling. By 1928 the piers were well under way and staging commenced from each bank. By 1929 all the piers were in place and waters had risen to the base of the piers. Erection of the trusses was underway. Falsework of underslung, divided, Warren-type metal trusses supported on three intermediate steel lattice towers, were used as staging for erecting the Pratt trusses. These were assembled in situ with the use of a travelling crane running across the falsework, and hot rivetting of preformed, punched and cut angle and flat section steel. As the permanent trusses were completed the staging was dismantled and moved on to the next span (SRWSC collection, State Library of Victoria Picture Collection).

Steel work for the bridge was fabricated at least in part, by Vickers Ruwolt of Burnley Melbourne. Photographs of components such as the truss members and bearings are in the collection of the Museum of Victoria. At least one of the main trusses was trial assembled at Vickers Ruwolt's Burnley works, probably one of the largest structures to be erected in this fashion.

The bridge was clearly seen as a landmark and complementary to the Hume Dam itself in terms of national pride and potential tourist value. The SRWSC documented the bridge's construction and produced a series of lantern slides showing progress. A number of hand coloured slides and images were produced of the finished bridge to show it at its most impressive. The Victorian Railways also produced its own series of photographs in the 1940s and 1950s presenting the bridge as part of a dramatic landscape and engineering achievement, probably for promoting tourist visits (by train) to the region. The bridge has been included in several Postcard series of the natural and man-made features of Albury in the 1950s and 1960s under titles such as "A Souvenir of Beautiful Albury" (State Library Picture Collection, Victoria).

The town of Bellbridge at the southern [Victorian] end of the bridge, was created to replace facilities inundated by the reservoir. The bridge is currently managed by River Murray Water, although it is understood that the RTA, VicRoads and River Murray Water are negotiating on the future management responsibility for the bridge. A current 33 tonne load limit applies and recent tenders have been advertised (VicRoads tender 5858) for the cleaning and repainting of the bridge.⁶

3.18.4 Photographs – Building the Bethanga Bridge

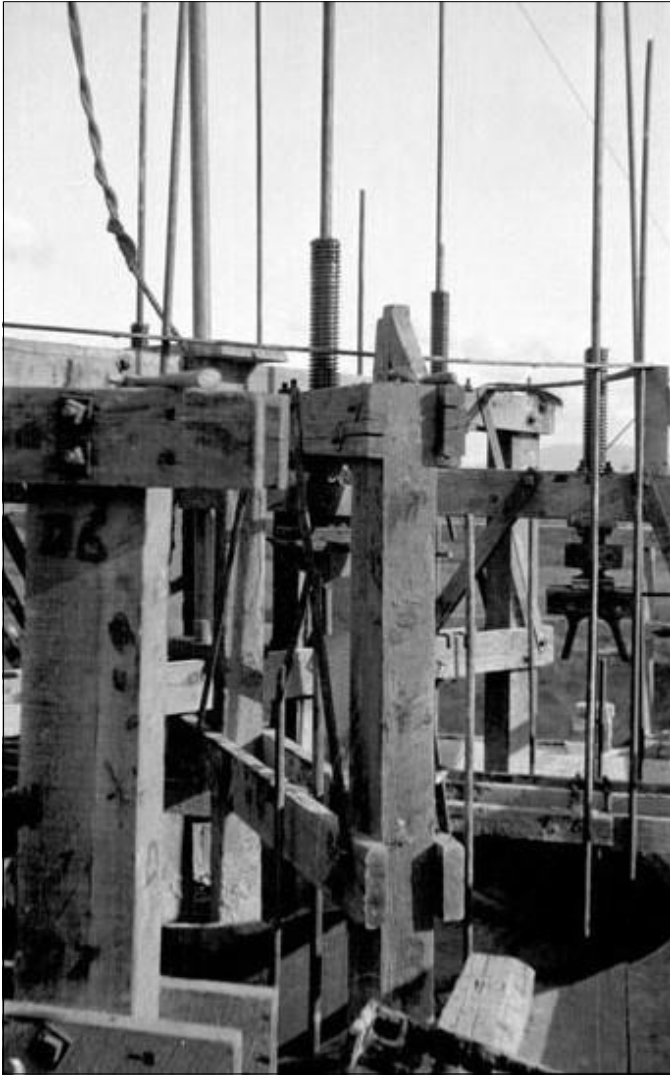


Constructing the movable formwork for the bridge piers, c1927.

Photos from the Public Transport Corporation (Victorian Railways) Collection in Public Records Office Victoria.

⁶ Information regarding management of the bridge is dated 2006. It is understood the bridge is now (2015) managed by the NSW Roads and Maritime Services (Authority?) South West Region in Wagga Wagga.

3.18.4 Photographs – Building the Bethanga Bridge (Continued)

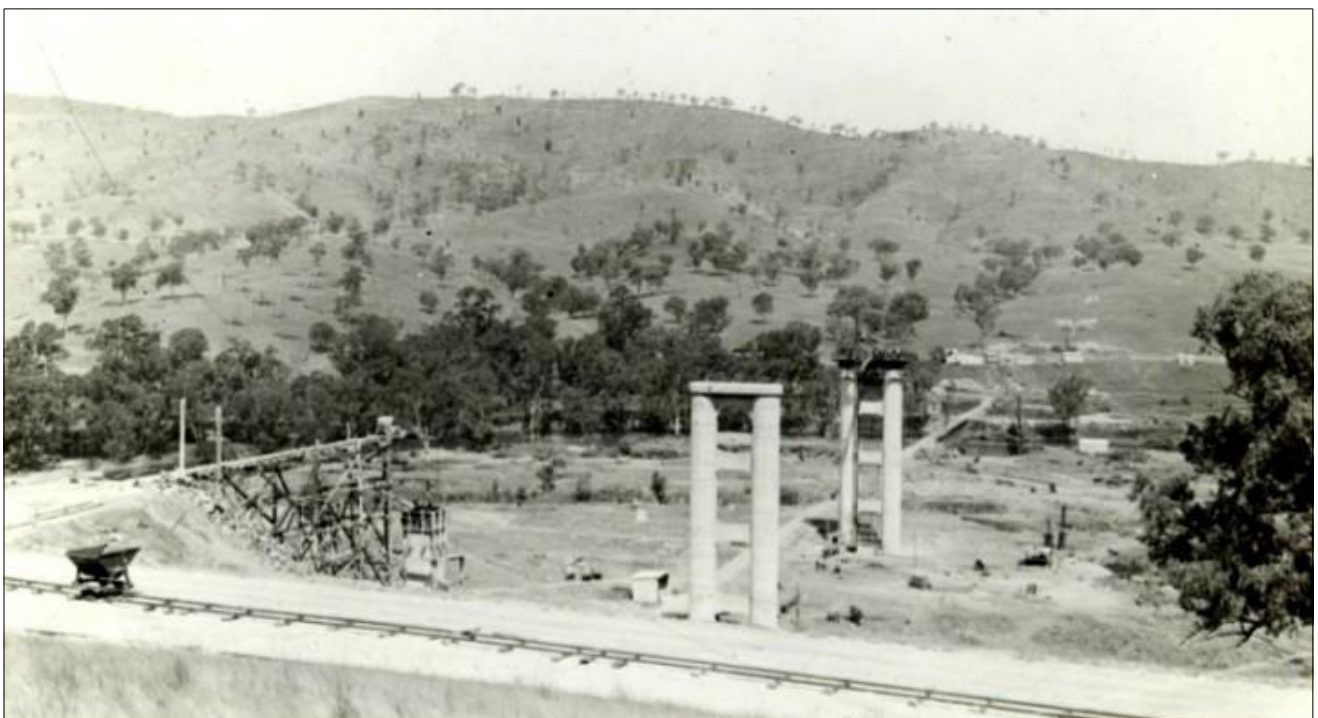


Left: Detail of the movable timber formwork on one of the concrete piers, circa 1927.

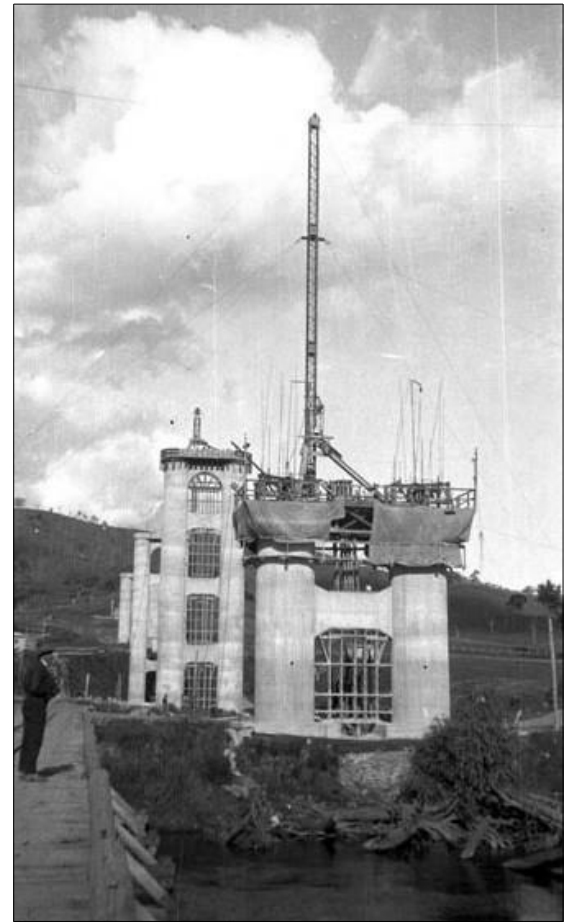
Photo: from the Public Transport Corporation (Victorian Railways) Collection in Public Records Office Victoria.

Below: Bethanga Bridge under construction c1927. Note the small trolleyway which would have carried wet concrete in skips from a batching plant nearby to where it was piped into the abutment pier formwork on the NSW side of the bridge.

Photo: From a Victorian Railways Collection in the State Library of Victoria



3.18.4 Photographs – Building the Bethanga Bridge (Continued)

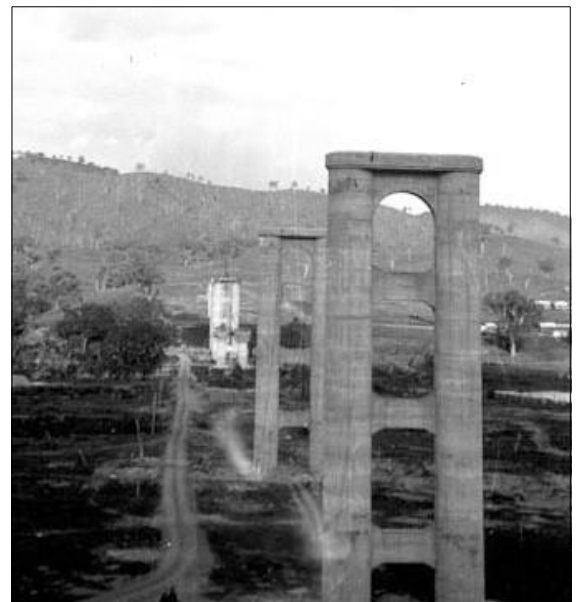


Clockwise from top left:

1. Building the abutment piers & cap on the NSW side circa 1927.
2. Building piers using movable formwork – 1927-28.
3. This pier appears to be the last one built on the Victorian side – possibly 1928.
4. Piers in shade on the NSW side, and in sunlight in the distance in Victoria, 1928.

Photos 1, 2, & 4: from the Public Transport Corporation (Victorian Railways) Collection in Public Records Office Victoria.

Photo 3: From a Victorian Railways Collection in the State Library of Victoria



3.18.4 Photographs – Building the Bethanga Bridge (Continued)

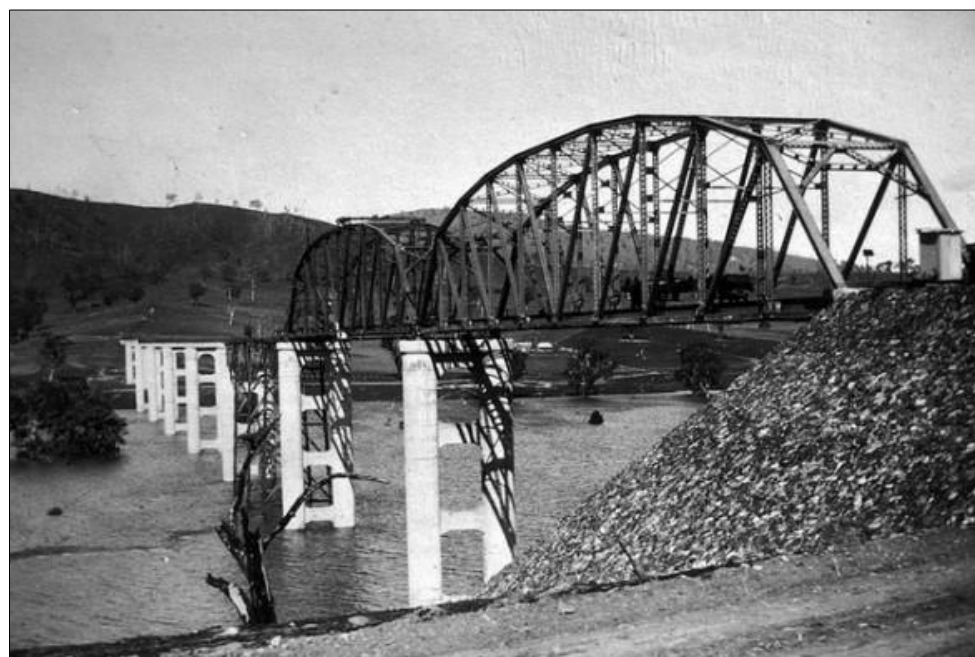
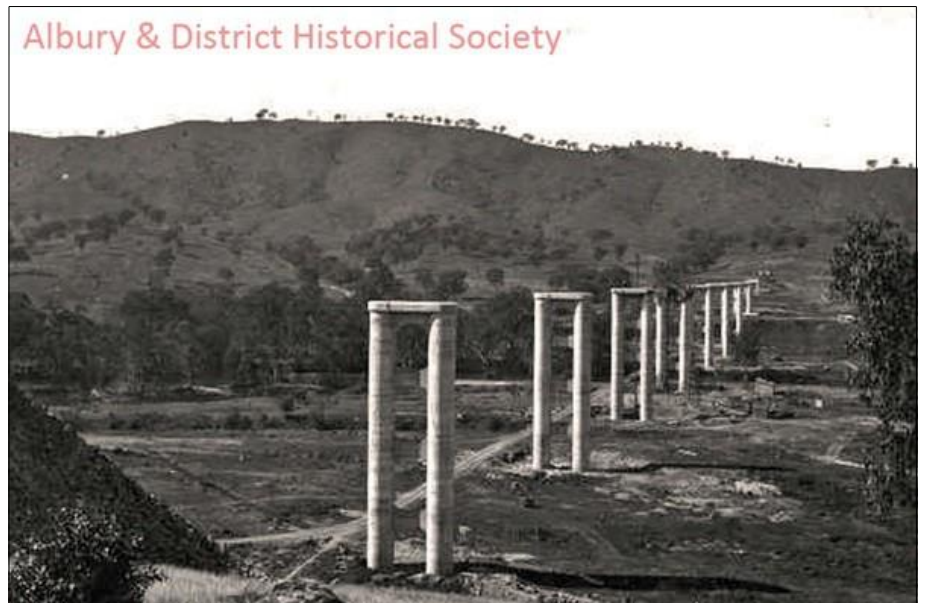


Left: A general view of some of the Bethanga Bridge piers, marching across the valley, circa 1928.

Photo: From the Public Transport Corporation (Victorian Railways) Collection in Public Records Office Victoria.

Right: Another view of the Bethanga Bridge piers, marching across the valley circa 1928.

Photo: From the collection of the Albury and District Historical Society.



Left: Pushing the reassembled Pratt Trusses out across the pier caps from the NSW abutments in 1929.

Photo: John Dallinger Collection, Foto Supplies Albury.

3.19 Heritage Listings**3.19.1 New South Wales Heritage Act – State Heritage Register**

Register listing number: 01750

Name: Bethanga Bridge

Gazette Date 26th May 2006, Gazette Number 68

3.19.2 NSW Roads & Maritime Services Heritage & Conservation Register

Item Number: 4302002 on the Section 170 NSW State agency register

Name: Bethanga Bridge over the Murray River

3.19.3 Albury City Council – Albury Local Environment Plan 2010, Schedule 5 Environmental Heritage

Item Number: I-359 State Significance

Name: Bethanga Bridge (on the Riverina Highway crossing Lake Hume)

3.19.4 Heritage Victoria – listed on the Victorian State Heritage Register

VHR number: H0989

Name: Bethanga Bridge

3.19.5 National Trust of Australia (Victoria)

File Number: B7225

National Trust Bridges Database Reg. No.4293

Name: Bethanga Bridge over Hume Weir (Murray Arm)

4. Assessment of Significance:⁷

4.1 Historical Significance:

Bethanga Bridge is of historical significance for its association with the construction of Hume Weir as a major national undertaking in the early twentieth century. Apart from the dam wall itself, it is the most substantial visible construction on the Hume Weir which relates to the Murray Rivers Water Agreement signed by three states and the Federal Government in 1914.

The bridge reflects the engineering and design approaches of the Victorian State Rivers and Water Supply Commission (SRWSC) and New South Wales Public Works Department in the late 1920s and the influence of American engineering practice in the use of the Pratt Truss.

The bridge reflects the extraordinary political clout and influence of the farming communities along the river from Talgarno to Granya and beyond, who had fought until 1895 to get a proper bridge across the river at Gold Creek Talgarno to give them access for their produce to the nearby markets of Albury and Wodonga, access to the wider regions and the big cities by railway from Albury and Wodonga and access to Albury and Wodonga for shopping and entertainment and etc. To these communities the building of the Weir was a disaster. They would not only lose the easy, short access afforded by the Gold Creek bridge, but many of them would lose the most valuable acres of their land to the rising waters. WH Ferguson, a Talgarno landholder notes: *At the central part of Talgarno fertile flats extend back from the river for two miles.*⁸ The citizens of Talgarno, and Bethanga and Granya and further were not going to be 'duddled' again – a new, high level bridge to replace the Gold Creek one before it was drowned was not to be denied.

As a major bridge built by other than a state road or rail authority, the Bethanga Bridge is unusual, and is the most substantial bridge erected by water authorities, which otherwise were responsible for large numbers of smaller bridges needed to cross the drainage and irrigation channels downstream of irrigation reservoirs such as Hume. It compares with the other known SRWSC constructed bridge - Glenmaggie Bridge – but on a much larger scale commensurate with the size of the Hume weir.

7 The points of significance and statement of significance have been taken largely from the various NSW and Victorian heritage registers mentioned in Section 3.19 above

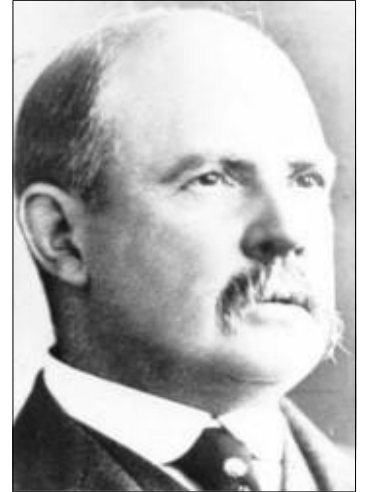
8 WH Ferguson, *Doomed Talgarno – A History*.

4.2 Association with Historic Individuals or Firms:

4.2.1 Percy Allan & the NSW Public Works Department:

The Bethanga Bridge has a possible connection with the famous bridge design engineer Percy Allan, Chief Engineer, NSW Public Works Department from 1918. Allan was responsible for the design of the Pratt Truss Tom Ugly's Bridge in Sydney which was completed in 1927, the year after he retired in March 1926. It is barely possible that Percy Allan was responsible for the design of the Bethanga Bridge, which took place in the PWD offices in 1926. He had retired in March, but it is clear that his influence in the office was still strong. It is also clear that the design of the Bethanga Bridge was a considerable refinement on that of Tom Ugly's, appearing more elegant and more economical. Percy Allan died in May 1930, only a few months before the Bethanga Bridge was opened.

Right: Percy Allan, photo from the Glebe Society.



Below Right: Charles Ruwolt, photo courtesy of Geoff Hayes.

4.2.2 Charles Ruwolt and his firm Charles Ruwolt Pty Ltd:

The builder of the nine Pratt trusses, and most of the other steel work on the bridge, was the Richmond, Melbourne firm of Charles Ruwolt Pty Ltd. In 1902 Charles Ruwolt opened a foundry at Wangaratta, Victoria, on the edge of the Ovens goldfields. He started making windmills and repairing agricultural machinery, but soon branched out into the design and construction of gold dredges, which were much in demand to replace the water profligate gold sluicing process. His dredges must have been pretty good, because within a few years he was exporting them to the Malay States, Siam (Thailand), the Philippines, South Africa and New Guinea. In 1914 he moved the firm to Burnley, where it occupied an 8 hectare site fronting Victoria Street and adjoining the Yarra River – much more convenient for his then mainly export trade.

By 1927 Charles Ruwolt had become a major Melbourne industrialist. The firm had *diversified into heavy industrial work, producing road-making equipment, crushing machinery for mine-work, and hydraulic presses for the nascent car industry*.⁹ Making the trusses for Bethanga Bridge must have seemed like a return to the old days, where the mining dredges were erected in the yard, making sure all the pieces fitted together, named and numbered, and deconstructed again for shipment to exotic shores. There are photos in the Vickers Ruwolt photo collection in the Museum of Victoria, of the bridge trusses erected in Ruwolt's yard, like the dredges of old.¹⁰ By the time WW2 broke out, Ruwolt's had become one of the largest engineering firms in Australia, and it became a major manufacturer of munitions during the war. Charles Ruwolt died in November 1946. His great industrial enterprise was sold to Vickers Ltd (UK) in 1948, and became widely known in Australia as Vickers Ruwolt.



4.3 Technical/Scientific Significance:

Bethanga Bridge is of scientific (technical) significance for the unusual use in Victoria of Pratt trusses, a predominantly NSW technology, in its construction. The Pratt truss was frequently used in New South Wales but this represents a rare example of its use in Victoria. The use of this system in this instance, its design by New South Wales and construction by Victoria, also represents the cooperation of New South Wales and Victoria in the development and ongoing use of major infrastructure. Its construction methods are also of note in the use of staged construction from abutments along temporary underslung Warren trusses.¹¹

9 Geoff. Hayes, 'Ruwolt, Charles Ernest (1873–1946)', Australian Dictionary of Biography, see <http://adb.anu.edu.au/biography/ruwolt-charles-ernest-8309/text14571>,

10 See <http://museumvictoria.com.au/collections/themes/3153/vickers-ruwolt-collection>

11 This last statement about construction methods is taken directly from the RMS Register, but with no reference source or corroboration.

4.4 Research Potential:

Most information in this nomination has been taken from various NSW and Victorian heritage registers and little or nothing is reported about the actual construction period, the people and organisations involved, or methods of construction (except for the last sentence in item 4.3). Marion Taylor's brief history gives many insights, and shows there is rich potential here for extensive research into these fields, and the production of an interesting engineering biography of the bridge.

4.5 Social Significance

The Bethanga Bridge had social (and perhaps political) significance through the way it got the two States (NSW and Victoria) and their various departments and authorities to work together on a major project – an ongoing process, which continues to operate successfully with respect to maintenance and upgrades, 80 years after the bridge was completed. The bridge had great social significance for the farming communities for many miles up the river. It maintained their simple access to Albury and Wodonga for trade, transport, commerce and general comfort in living (doctors, hospitals, meeting places, entertainment, all sorts of shops, the railways, the saleyards, secondary education) all of which had been seriously threatened by the building of the weir and the flooding of their only previous bridge. The convenience and benefit of this access remains today – again, 80 years after the bridge was opened.

In recent years, Bethanga Bridge has attained some local significance as a tourism destination, for sight-seeing, boating and fishing – in conjunction with the weir itself and the dam wall.

4.6 Rarity:

The Bethanga Bridge is thought to be the only bridge which straddles the boundary of two states. Where the NSW-Victoria border impinges on the Murray River, the border line is taken to be the south bank of the river. All other bridges crossing the river are entirely inside NSW. In the case of the Hume Weir, the official border follows the line of the original south bank of the river, and thus several spans of the bridge are inside Victoria. As a major bridge built by other than a state road or rail authority, Bethanga Bridge is rare and is the most substantial bridge erected by water authorities (that is, the Victorian State Rivers and Water Supply Commission). It is the only built structure shared by NSW and Victoria.

4.7 Representativeness:

Bethanga Bridge is a representative example of Pratt Truss design displaying the main characteristics at a scale that demonstrates the effectiveness of the design over long spans and of its repetition to create a bridge of considerable overall length. The use of compound riveted sections in the steel trusses and the refined details of connections and bearings are representative of bridges of this age (the Sydney Harbour Bridge has similar detailing). These bridges represent the final level of refinement in steel truss bridges.

4.8 Integrity/Intactness:

The original timber decking has been raised once and twice replaced with concrete decking, the railings replaced and the NSW approach modified. Nevertheless, Bethanga Bridge remains substantially the same structure as completed in 1930.

4.9 Aesthetic Significance

The bridge is of aesthetic significance for its dramatic rural setting over a wide expanse of water (when lake levels are high) and occasionally at great heights over broad river flats (when the lake is down). It is also of aesthetic significance for the vast scale and length and the rhythmic patterning of repeated geometric motifs of the trusses. Apart from all that, the general opinion of the bridge is that it is just plain beautiful!

5 Statement of Significance:

The Bethanga Bridge is a long, nine-span, riveted-steel, variable depth, Pratt Truss road bridge of nine principal spans of 82 metres and a total length of 752 metres over the flooded valley of the Murray River, now part of Hume Reservoir. The bridge dates from 1927-1930 when the Hume Weir was completed and the backed-up waters inundated this section of the river and consequently cut off the old low level bridge over the Murray. The State Rivers and Water Supply Commission of Victoria and the New South Wales Department of Public Works were responsible for the construction works for the Hume Weir under the River Murray Waters Agreement of 1914.

Bethanga Bridge is of historical significance for its association with the construction of Hume Weir as a major national undertaking in the early twentieth century. Apart from the dam wall itself, it is the most substantial visible construction on the Hume Weir.

The bridge reflects the extraordinary political clout and influence of the farming communities along the river from Talgarno to Granya and beyond, who had fought until 1895 to get a proper bridge across the river at Gold Creek Talgarno to give them access for their produce to the nearby markets of Albury and Wodonga.

To these communities the building of the Weir was a disaster. They would not only lose the easy, short access afforded by the Gold Creek Bridge, but many of them would lose the most valuable acres of their land to the rising waters.

As a major bridge built by other than a state road or rail authority, the Bethanga Bridge is unusual, and is the most substantial bridge erected by water authorities, which otherwise were responsible for large numbers of smaller bridges needed to cross the drainage and irrigation channels downstream of irrigation reservoirs such as Hume.

The Bethanga Bridge was associated with two key organisations and two important individuals.

The bridge has a possible connection with the famous bridge design engineer Percy Allan, Chief Engineer, NSW Public Works Department from 1918. Allan was responsible for the design of the Pratt Truss Tom Ugly's Bridge in Sydney which was completed in 1927, the year after he retired in March 1926. It is barely possible that Percy Allan was responsible for the design of the Bethanga Bridge, which took place in the PWD offices in 1926.

The builder of the nine Pratt trusses, and most of the other steel work on the bridge, was the Richmond, Melbourne firm of Charles Ruwolt Pty Ltd. In 1902 Charles Ruwolt opened a foundry at Wangaratta, Victoria, on the edge of the Ovens goldfields. He started making windmills and repairing agricultural machinery, but soon branched out into the design and construction of gold dredges, which were much in demand to replace the water profligate gold sluicing process.

In 1914 he moved the firm to Burnley, where it occupied an 8 hectare site fronting Victoria Street and adjoining the Yarra River – much more convenient for his then mainly export trade. By 1927 Charles Ruwolt had become a major Melbourne industrialist. The firm had diversified into heavy industrial work, producing road-making equipment, crushing machinery for mine-work, and hydraulic presses for the nascent car industry. Making the trusses for Bethanga Bridge must have seemed like a return to the old days, where the mining dredges were erected in the yard, making sure all the pieces fitted together, named and numbered, and deconstructed again for shipment to exotic shores.

The Bethanga Bridge had social (and perhaps political) significance through the way it got the two States (NSW and Victoria) and their various departments and authorities to work together on a major project – an ongoing process, which continues to operate successfully with respect to maintenance and upgrades, 80 years after the bridge was completed. The bridge had great social significance for the farming communities for many miles up the river. It maintained their simple access to Albury and Wodonga for trade, transport, commerce and general comfort in living (doctors, hospitals, meeting places, entertainment, all sorts of shops, the railways, the sale yards, secondary education) all of which had been seriously threatened by the building of the weir and the flooding of their only previous bridge. The convenience and benefit of this access remains today.

The Bethanga Bridge is thought to be the only bridge which straddles the boundary of two states. Where the NSW-Victoria border impinges on the Murray River, the border line is taken to be the south bank of the river. All other bridges crossing the river are entirely inside NSW. In the case of the Hume Weir, the official border follows the line of the original south bank of the river, and thus several spans of the bridge are inside Victoria. It is the only built structure shared by NSW and Victoria.

Bethanga Bridge is a representative example of Pratt Truss design displaying the main characteristics at a scale that demonstrates the effectiveness of the design over long spans and of its repetition to create a bridge of considerable overall length. The use of compound riveted sections in the steel trusses and the refined details of connections and bearings are representative of bridges of this age (the Sydney Harbour Bridge has similar detailing). These bridges represent the final level of refinement in steel truss bridges.

The bridge is of aesthetic significance for its dramatic rural setting over a wide expanse of water (when lake levels are high) and occasionally at great heights over broad river flats (when the lake is down). It is also of aesthetic significance for the vast scale and length and the rhythmic patterning of repeated geometric motifs of the trusses.

6 Level of Significance:

The Bethanga Bridge has State and Local Significance as detailed in sections 4.1 to 4.9 above.

It is considered to be of National Engineering Heritage significance, because of its existence in two States, and because the States of NSW and Victoria have both considered it worthy of registration on both of their State Heritage Registers.

The bridge forms an integral part of the Hume Reservoir project which is clearly a project of national significance ¹.

¹ Hume Dam was awarded a National Engineering Landmark under the EHA Heritage Recognition Program in April 2005.

7 Interpretation Plan

7.1 General Approach

The interpretation Plan will be carried out in accordance with the 2012 edition of the *Guide to the Heritage Recognition Program* which can be found on the EHA web site at www.engineeringheritage.com.au.

This will consist of interpretation developed in liaison with the owners (VicRoads and/or RMS NSW) and the Heritage Recognition Committee. The interpretation panel will be unveiled at a public ceremony probably on 11th October 2015.

The bridge straddles the border of Victoria and NSW across the waters of the Hume Dam. The road authority concerned may depend on the location of the interpretation and ceremony i.e. in NSW or Victoria (however see below). We would need to talk to the appropriate road authority (probably NSW RMS) and get their agreement to:

- Discuss a suitable site for interpretation with Engineering Heritage Victoria.
- Discuss suitable interpretation with Engineering Heritage Victoria.
- Agree to the placing of a marker and interpretation panel within the road reserve.
- Agree to the conduct of an unveiling ceremony for the Heritage Recognition at the site adjacent to the interpretation and with due regard to road safety.
- The ceremony will be held in the vicinity of Bethanga Bridge, probably in the layby on the NSW side of the bridge adjacent to the west-bound lane.

There appear to be safe pull-off areas for west-bound traffic on both the Victorian side and the NSW side for parking a car, but there is no suitable area for the placement of a heritage marker on the Victorian side. There are double lines everywhere in the vicinity of the bridge.

However, there is space for parking a number of cars, and possibly a bus, on the left side of the road heading east on the NSW side, and there is a large area of space for placing the heritage marker and for parking cars on the right side of the road heading east on the NSW side of the bridge. Furthermore, the traffic is travelling slowly at that point, and it is possible to cross the road safely on foot after parking. Also, it makes sense to place the heritage marker on the NSW side of the bridge, because the bridge is actually owned and maintained by the State of NSW.

It is anticipated that the appropriate interpretation in this instance will most likely be a “standard panel” as detailed below. The panel would incorporate a representation of the award disc presented which is likely to be an Engineering Heritage Marker, subject to the decision of the national Heritage Recognition Committee.

The proposed date for the ceremony is in association with the Regional Heritage Weekend on Sunday 11th October 2015, in the morning.

7.2 General Attributes of the Interpretation Panel:

- 1) A title “**Bethanga Bridge**”
- 2) A sub title: To be developed as part of interpretation panel design process.
- 3) Logos of Engineers Australia, RMS, VicRoads and possibly state government logos to be incorporated.
- 4) The marker plate mounted on the crossbar of the interpretation panel support frame below the panel.
- 5) The date and other details of the marking ceremony.
- 6) Text should be 24 point Arial Bold
- 7) Maximum text should be 500 words
- 8) Historic photographs to be selected.

7.3 The Interpretation Panel:

1. Size to be nominally 1200 mm wide by 600 mm high.
2. The panel to be constructed of vitreous enamel-on-steel plate or vinyl film-on-aluminium with flanges.
3. The panel to be mounted on the standard EHA steel mounting frame of the type used in Victoria as shown at Appendix 1.

7.4 Possible Interpretation themes for Interpretation Panels

This will be a standard panel with the following themes:

- History of the Hume Dam.
- The history of the Bethanga Bridge.
- NSW Public Works Department, Percy Allan, the Pratt Truss and the design of the bridge.
- Charles Ernest Ruwolt of Charles Ruwolt Pty Ltd of Richmond, manufacturer of the bridge trusses.
- Victorian State Rivers & Water Supply Commission, which built the bridge

7.5 Preliminary Text Blocks for Interpretation Panels

To be developed as part of interpretation panel design process.

7.6 Interpretation Panel Design

To be inserted when design completed.

8 References:

Ferguson, William Hamilton – *Doomed Talgarno – A History*, self-published c1929

Hayes, Geoff – *Ruwolt, Charles Ernest (1873–1946)*, Australian Dictionary of Biography, see <http://adb.anu.edu.au/biography/ruwolt-charles-ernest-8309/text14571>,

Museum Victoria – See <http://museumvictoria.com.au/collections/themes/3153/vickers-ruwolt-collection>

Taylor, Marion – *A Short History of the Bethanga Bridge*, unpublished document.

New South Wales Heritage Act – State Heritage Register number 01750

NSW Roads & Maritime Services – Heritage & Conservation Register –
Item Number: 4302002 on the Section 170 NSW State agency register

Albury City Council – Albury Local Environment Plan 2010, Schedule 5 Environmental Heritage –
Item Number: I-359 State Significance

Heritage Victoria – listed on the Victorian State Heritage Register – VHR number: H0989

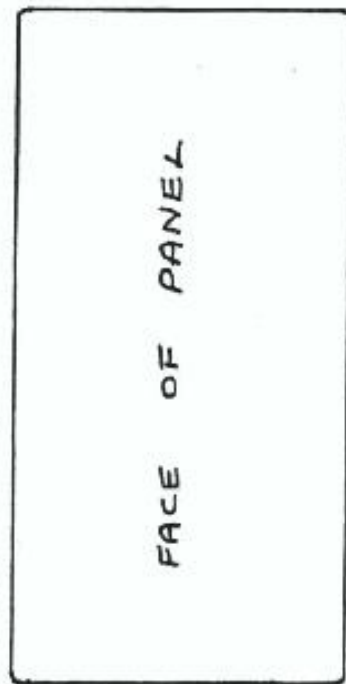
National Trust of Australia (Victoria) – File Number: B7225

Also National Trust Bridges Database Reg. No.4293, and
National Trust of Australia (Victoria) Initial Draft Classification Report for the Bethanga Bridge.
Name: Bethanga Bridge over Hume Weir (Murray Arm)

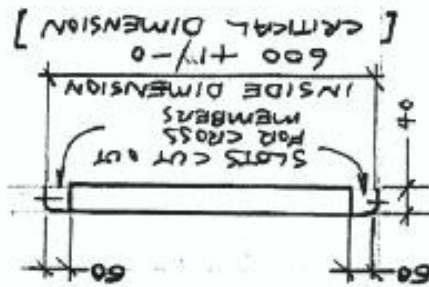
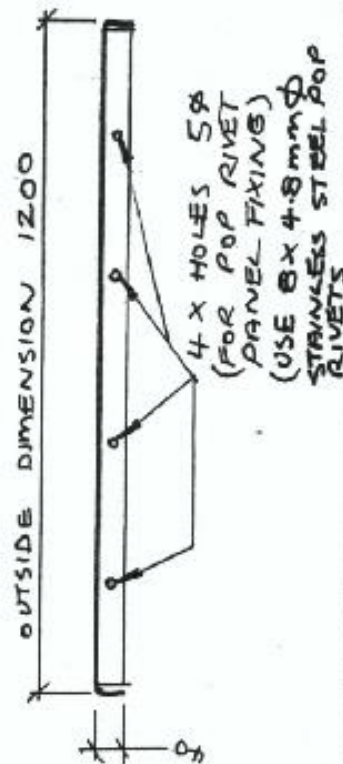
Nomination prepared by: Margaret J. Doring, FIEAust, CPEng, MICOMOS.

Appendix 1: Interpretation Panel & Mounting Frame Drawings

DIMENSIONS IN MM
SCALE: NOT TO SCALE



RADIUS OF
FOLD DOWN
NOT MORE
THAN 5mm
ALL ROUND



- NOTES:
- 1) EDGES FOLDED DOWN
ALL ROUND 40mm
 - 2) PANEL REFLECTIVE VINYL
FILM WITH UV LAMINATE
ON ALUMINIUM SHEET

DRAWN: OWEN PEARKE
DATE: 14 APRIL 2011

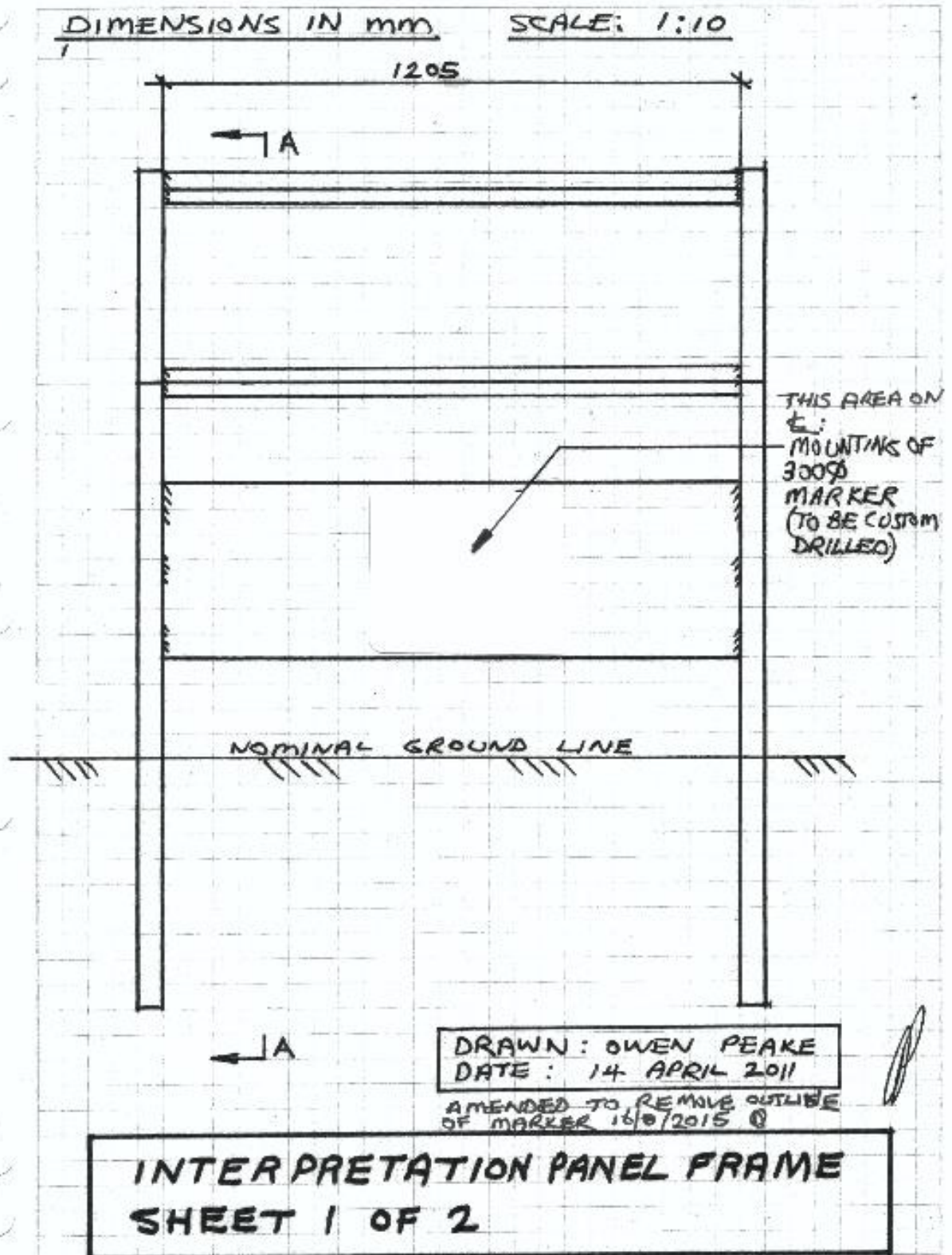
REVISED
19/9/2013

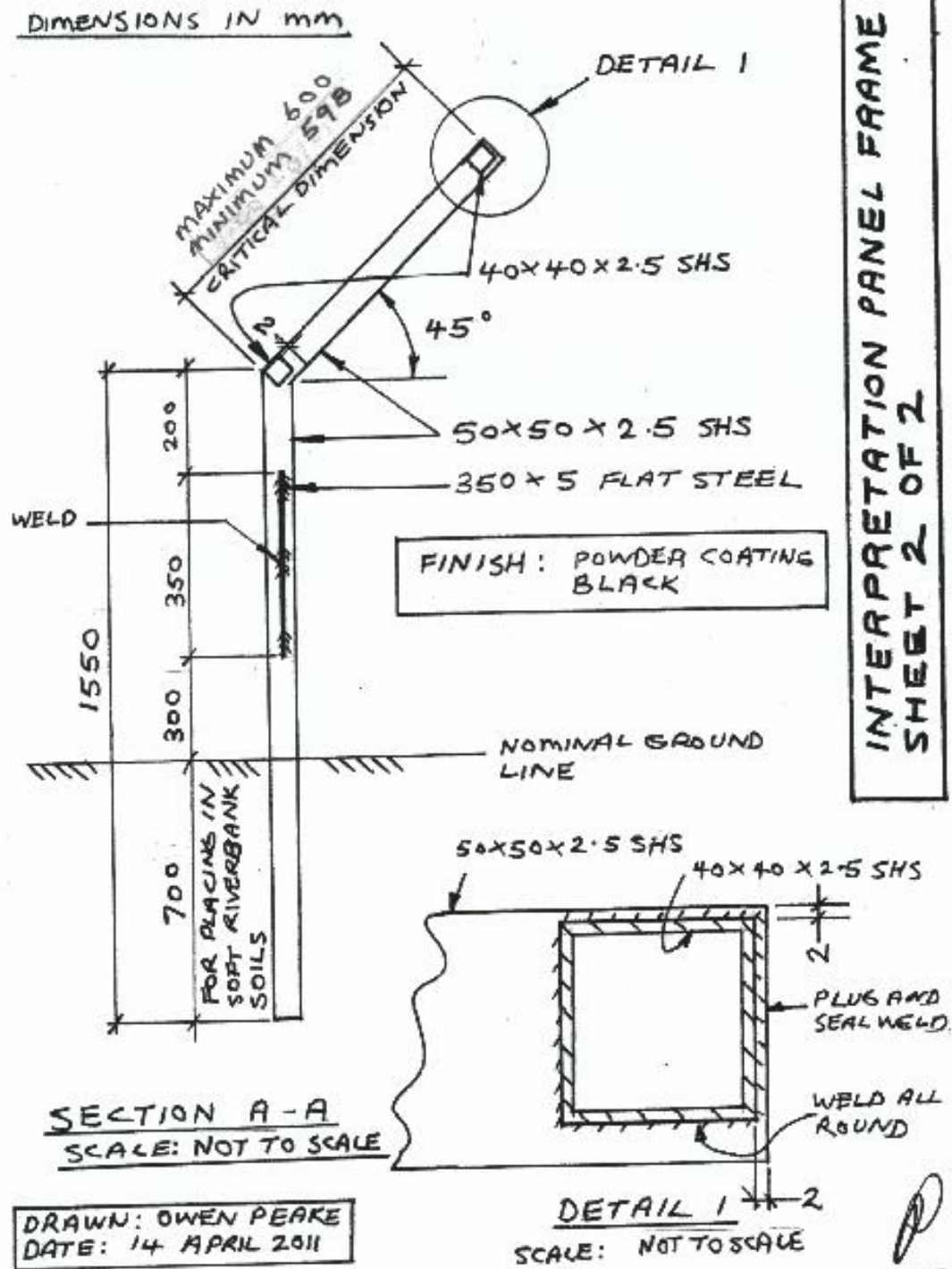
DRAWING No: EHA007

INTERPRETATION PANEL

STANDARD PANEL
(VINYL-ON-ALUMINIUM)

5mm Squares





CHANGE CONTROL

VERSION 1	22 July 2015	First draft by MD	
VERSION 2	6 August 2015	Second draft by MD	
VERSION 3	19 August 2015	Additions by OP	10,272 words
VERSION 4	26 September 2015	Minor Editing by OP	10,301 words
VERSION 5	30 September 2015	Replaced imagers cover plus p2 + Minor Editing by MD	10,305 words

Outstanding Items:

Copy of Owners Approval Letter	p5
Copy of Interpretation Panel	p23